BEFORE THE

KENTUCKY PUBLIC SERVICE COMMISSION

In the Matter of:

APPLICATION OF LOUISVILLE GAS AND ELECTRIC COMPANY FOR APPROVAL OF AN ALTERNATIVE METHOD OF REGULATION OF ITS RATES AND SERVICE	))))	CASE NO. 98-426

TESTIMONY OF

LAWRENCE KAUFMANN,
SENIOR ECONOMIST

CHRISTENSEN ASSOCIATES

Q. Please state your name and business address.

A. My name is Lawrence Kaufmann. My business address is 4610 University Avenue, Madison, Wisconsin 53705.

Q. What is your position?

A. I am a Senior Economist at Christensen Associates, an economic consulting firm.

Q. Please describe your work experience.

A. I joined Christensen Associates in 1993 as part of the incentive regulation (now regulatory strategies) practice. Since then, I have been involved in numerous performance-based regulation ("PBR") projects. Prior to joining Christensen Associates, I completed a Ph.D. in economics at the University of Wisconsin. A complete statement of my education and work experience is attached to this testimony as Appendix A.

Q. What is the purpose of your testimony?

A. I will be testifying about the service quality incentive plans proposed by Louisville Gas and Electric Company ("LG&E") and Kentucky Utilities Company ("KU") (jointly referred to as "the Companies").

Q. Please explain the term "service quality incentive."

A. A service quality incentive is a mechanism that creates incentives for utility companies to maintain or improve their quality of service. It does this by rewarding or penalizing a company depending on its quality performance.

A service quality incentive typically has three basic elements: (1) quality measures, (2) benchmarks, and (3) award mechanisms.

Quality measures are the dimensions of a company's service that are monitored under the plan.

Each quality measure is judged against a quality benchmark or "performance standard."

An award mechanism rewards or penalizes utilities depending on the relationship between quality measures and quality benchmarks. For example, if service quality as determined by the current quality measures is inferior to benchmark levels, a penalty may be warranted. Conversely, quality that is superior to benchmark levels can result in a reward.

Q. Why is service quality important for utilities under a PBR proposal?

A. Quality matters to customers in competitive and regulated markets alike. In most markets, a firm can lose sales to competitors if customers believe that the company's products are not a good value for the money. This risk of lost sales automatically creates incentives for firms to provide appropriate quality levels. These incentives are weaker for regulated utilities since sales are less likely to decline if quality falls. A quality incentive strengthens incentives to

maintain quality by linking the utility's financial performance more directly to its measured quality of service.

Quality incentives are especially appropriate as part of a comprehensive PBR package. Many PBR mechanisms create incentives for utilities to reduce costs. One way to cut costs is to reduce resources used to provide quality. An incentive targeted at service quality can help to counter-balance other PBR components to insure that cost-cutting is not achieved at the expense of lower quality.

Q. How will the service quality of LG&E and KU be measured?

A. Each company's quality of service will be measured by reviewing its performance in six areas under three general categories. The categories are: (1) System Reliability, (2) Customer Satisfaction, and (3) Employee Safety.

(1) System Reliability

(a) the System Average Interruption Duration Index ("SAIDI");

(b) the System Average Interruption Frequency Index ("SAIFI");

(c) the Momentary Average Interruption Frequency Index ("MAIFI") for large industrial customers;

(2) Customer Satisfaction

(d) the overall satisfaction of residential customers;

(e) residential customers' satisfaction with the handling of their telephone calls; and

(3) Employee Safety

(f) the Occupational Safety and Health Administration Recordable Incidence Rate ("OSHA Recordable Incidence Rate") of employee accidents and illnesses.

Q. Why were these measures chosen?

A. These measures are important for a number of reasons. First, each is an objective measure of utility service that is clearly valuable to customers, employees, and regulators. For example, the reliability of power supplies is important to all customers and is reflected in the frequency and duration of sustained (i.e. more than one minute) interruptions. Large industrial customers can be even more dependent on reliable power supplies and often suffer significant economic losses with even a momentary interruption. The MAIFI measure is designed to reflect the concerns of these customers.

Quality also can be directly measured by customers' perceived satisfaction with utility services. The plan contains two customer satisfaction measures -- one specifically related to transactions with utility employees (overall satisfaction with the handling of phone calls) and the other more broadly defined and thus capturing many intangible aspects of quality.

Employee safety is critical to the Commission and employees alike. Like the other measures, employee safety can be jeopardized when utilities have stronger incentives to cut costs. It is therefore appropriate to create countervailing incentives to maintain safety.

Second, the company can influence the value of each measure through its actions. It is important that an incentive plan be designed so that rewards and penalties result from the behavior of utility managers rather than effects that are beyond the company's control. If important quality attributes nevertheless can be affected by events beyond managers' control, the quality measure should exclude the impact of such events to avoid imposing arbitrary rewards or penalties.

Third, both LG&E and KU currently collect data on each measure or have plans to begin collecting these data. This fact was an important consideration because the Companies wanted their PBR tariffs to be as consistent as possible.

Finally, the chosen measures balance the needs of comprehensiveness and simplicity. That is, the plan is designed to be comprehensive in terms of measuring the most important aspects of utility quality and yet not involve so many measures that it imposes administrative burdens on the

company or the Commission. I believe the six recommended measures achieve this goal.

Q. Please describe what methods can be used to establish reasonable benchmarks.

A. There are two main options for setting benchmarks. One option is to base benchmarks on the performance of utility peers. In this case, a utility's measured quality is compared to an average measure of peer utilities on the same measure. This approach is attractive since it uses information outside the company's own history to determine appropriate performance standards. It is also more consistent with the operation of competitive markets, where rewards or penalties primarily depend on performance relative to competitors. However, there also can be practical problems with this approach. The biggest difficulty is the lack of standardized definitions for many quality measures. For example, some utilities define a sustained interruption (as reflected in SAIFI) as lasting at least a minute, while for other utilities sustained interruptions must last at least five minutes. Peer-based benchmarks therefore should be examined carefully to determine that they are relevant for the subject utilities.

The other option is to rely on the company's historical performance as the benchmark. This is a natural approach, for one purpose of service quality incentives is to prevent

quality from declining. Historically-based benchmarks promote this goal since utilities are penalized when quality falls below a company's historical performance. However, commissions may question whether historical benchmarks are sufficient, especially if the company's historical performance is substandard.

Q. Please define the term "deadbands" and explain when they may be appropriate for use in service quality components of PBR tariffs.

A. The term "deadband" means a range around the benchmark where measured quality levels do not cause penalties or rewards. Deadbands are used to prevent penalties or rewards for small or random fluctuations in a measure. Measured quality can fluctuate from period to period because of random influences that are beyond management control. Deadbands can therefore control for these effects.

Q. Please explain the basic features of the award mechanism.

A. The award mechanism allows for both penalties and rewards. An award rate applies to each measure and determines the magnitude of the penalty or reward associated with a specified change in that measure (outside of the benchmark or deadbands). The mechanism is symmetric in that the same award rate is used when quality measures are above or below the benchmarks.

Q. Why does the mechanism allow for rewards as well as penalties?

A. It is sound public policy to allow rewards for superior quality. This is true for two main reasons. One is that all types of PBR, including service quality PBR, are designed to create incentives for utilities to improve their performance. Penalty-only plans may be sufficient to keep service quality from declining, but they do not create incentives for companies to improve quality. The quality of utility services is clearly important to customers and policymakers, so plans that allow rewards create incentives for utilities to improve performance in all areas that are valuable to outside parties.

Rewards for superior quality are also more consistent with the behavior of unregulated markets. In general, it is appropriate to design PBR plans so that they replicate the market-based incentives of firms to provide the most value to customers at the lowest cost. Customers in competitive markets routinely pay higher prices for higher quality products, and a symmetric service quality incentive reflects this phenomenon.

In addition, there are many precedents for regulators approving symmetric service quality plans for energy utilities. Quality incentives that allow for both rewards and penalties have been especially common in California and New York.

Q. How should award rates be chosen?

A. In general, the award rate for each measure should reflect its underlying value. This leads to appropriate rewards or penalties that result from a measured change in quality. For example, if the frequency of power interruptions increases, the award mechanism should compensate customers appropriately for their welfare losses resulting from the interruptions. An award rate for SAIFI that reflects its value to customers would lead to such a result.

System Reliability Measures

Q. How will SAIFI and SAIDI be measured under the incentive plan?

A. SAIFI and SAIDI will include all interruptions in excess of one minute, excluding severe storms where power has not been restored for at least 24 hours. These events should be excluded because they result from severe weather that is beyond company control. Excluding these storms therefore makes SAIFI and SAIDI more accurate measures of the companies' true performance in minimizing the frequency and duration of outages.

Q. What are the benchmarks for SAIFI and SAIDI?

A. For each company, the benchmarks for these measures will be their average values over the seven years between 1991 and 1997. The SAIFI benchmarks are 1.16 for LG&E and 0.76 for KU. As further explained in the testimony of Steve Wood of LG&E,

the difference in the SAIFI benchmarks reflects the difference in the customer density of the two utility systems. The SAIDI benchmarks are 65.8 minutes for LG&E and 67.0 minutes for KU.

Q. Did you consider using peer performance for SAIFI and SAIDI benchmarks?

A. Yes, but this was rejected for two reasons. One is that utilities define and measure SAIFI and SAIDI differently. This makes it more difficult to determine meaningful benchmarks based on peer data. Second, both companies' SAIFI and SAIDI figures typically outperform what are reported to be the industry's norms. Thus, if industry-based benchmarks were used, the Companies could allow SAIFI and SAIDI to decline without being penalized.

Q. Are there deadbands around the SAIFI and SAIDI benchmarks?

A. There are no deadbands around these benchmarks because the measured SAIFI and SAIDI values exclude the impact of severe storms on outage frequency and duration. Therefore, the measures themselves eliminate the effects of influences beyond management control and deadbands are not needed for this purpose.

Q. What are the award rates for SAIFI and SAIDI?

A. For every full interruption reflected in SAIFI that is above the benchmark, there will be an annual penalty of $1,700,000. Similarly, for each full interruption reflected in SAIFI that

is below the benchmark, there will be an annual reward of $1,700,000. For every minute that SAIDI is above the benchmark, there will be an annual penalty of $120,000. Similarly, for each minute that SAIDI is below the benchmark, there will be an annual reward of $120,000.

Q. Please explain how the award rates for SAIFI and SAIDI were determined.

A. Outage cost literature was reviewed to determine appropriate outage cost values for residential, commercial, and industrial customers. The values chosen were the averages for each customer group reported in a 1990 EPRI survey of 29 North American utilities on the outage costs they use for reliability planning. These values were $1.91/kWh for residential, $7.03/kWh for commercial, and $5.925/kWh for industrial customers, all in terms of 1990 prices. These values were updated to 1997 prices by multiplying each outage cost estimate by the growth rate in GDP-PI from 1990 to 1997.

The system-wide average outage cost then was computed as a weighted average of the 1997 dollar values for outage costs for each customer class; weights were equal to the average share of each group in the combined kWh sales of LG&E and KU. This value was $6.02/kWh. This figure is almost identical to an average outage cost estimate that the Tennessee Valley Authority recently has used in distribution planning.

This outage cost estimate was used to estimate the value of unserved energy in a typical one-hour outage by multiplying $6.02 by total kWh sales and dividing this product by the 8760 hours in 1997. Some outage cost literature finds evidence of both "fixed" and "variable" outage costs. The fixed costs are associated with the occurrence of an outage while the variable costs depend on outage duration. An estimate of the proportions of fixed and variable costs associated with residential and non-residential classes was applied to the mix of customers served by LG&E and KU. The details of this calculation are presented in Exhibit LK-1. These estimates showed that, system-wide, 19.2% of the cost of a one-hour outage is fixed and therefore directly related to SAIFI; the remaining 80.8% of the cost of a one-hour outage is related to SAIDI.

Multiplying the value of unserved energy by 19.2% leads to an estimate of the value for SAIFI of $1,702,409 for LG&E and KU customers. This value was "rounded" to $1,700,000 for one full interruption. Similarly, multiplying the value of unserved energy by 80% leads to an estimate of costs related to the duration of a one-hour outage of $7,164,302 for LG&E and KU customers. Dividing this figure by 60 yields a value of $119,405 for each minute reflected in SAIDI. This value was "rounded" to $120,000.

Q. How will MAIFI for large industrial customers be measured under the plan?

A. Neither company currently measures MAIFI. Collecting this data will require additional efforts. Both companies currently are evaluating what additional line monitoring equipment and information systems will be needed to monitor, track, and record MAIFI events. Upon approval of the PBR plan, a four-month process to implement reporting will be initiated. The introduction of this measure into the service quality component of the PBR plan will occur one year from the implementation of MAIFI reporting, or sixteen months from approval of the PBR plan.

Q. What are the benchmarks for MAIFI?

A. Since neither company currently collects MAIFI data, little information is available for setting a benchmark. As data become available, they will be examined in conjunction with Commission Staff to set appropriate benchmarks.

Q. What is the award rate for MAIFI?

A. This award rate also will be determined in the next year. LG&E and KU currently know very little about the exact magnitude of costs imposed by momentary outages on their industrial customers. However, it is known that these costs are much higher than for residential and many commercial customers and differ by industrial establishment. LG&E and KU

intend to undertake more research on the costs resulting from momentary interruptions, and these results will be used to establish a MAIFI award rate.

Customer Satisfaction

Q. How will the overall satisfaction of residential customers be measured under the plan?

A. Residential customers' overall satisfaction will be measured by the percent of customers who rate their overall satisfaction as "excellent," defined to be a score of 9 or 10 on a 10-point scale. LG&E has been collecting this data in a monthly Competitive Satisfaction Survey since January 1998. The plan is to extend this survey to KU in January 1999.

Q. What is the benchmark for Overall Customer Satisfaction?

A. The benchmark for Overall Customer Satisfaction will be the percentage of customers served by a peer group of utilities who rate their overall satisfaction as excellent. LG&E currently collects this data by sponsoring surveys of other utilities' customers. The same benchmark will apply to both LG&E and KU. The definition of "excellent" customer service for the peers also will be the same as that which applies to LG&E and KU.

Q. Please explain why this benchmark is appropriate.

A. In competitive markets, firms typically are rewarded with increased sales when their customers are more satisfied than their competitors' customers. Incentive plans comparing utilities to peer performance reflect this phenomenon. Also, since the same survey is used for LG&E and the peer utilities, there are no concerns that customer satisfaction is measured differently across companies.

Q. Is there a deadband around this benchmark?

A. Yes. LG&E began its Competitive Satisfaction survey in 1998, and its results to date show that the overall satisfaction of its customers is well above that of the peers. While in competitive markets this likely would lead to rewards for the Company, LG&E did not want to create any appearance that its benchmarks were set to generate "automatic" rewards. Accordingly, a one-way deadband of 10 percentage points has been added to the average overall satisfaction of the peer utilities. This means that neither LG&E nor KU will be rewarded unless their customers' overall satisfaction exceeds that of peer utilities by more than 10 percentage points. However, the Companies will be penalized whenever their customers' satisfaction falls below the average satisfaction for the peer group. Any satisfaction level that exceeds the average peer satisfaction by 10 percentage points or less will

not lead to penalties or rewards. This creates very strong incentives for LG&E and KU to maintain customer satisfaction levels well above those of comparable utilities.

Q. What is the award rate for overall customer satisfaction?

A. For every one percent that overall customer satisfaction is below the average for the peer utilities, there will be an annual penalty of $290,000. For every one percent that overall customer satisfaction is above the average for peer utilities plus 10 percentage points, there will be an annual reward of $290,000.

Q. Please explain the basis for this award rate.

A. As previously discussed, in competitive markets, differences in customer satisfaction often are rewarded by changes in sales. Firms with more satisfied customers tend to attract customers from their competitors. Conversely, firms with less satisfied customers often lose them to competitors. This same force is not currently operative for electric utilities, but it can be used to infer the underlying value of customer satisfaction. That is, the recommended value for customer satisfaction is based on an estimate of the utility revenues that, in a hypothetical competitive market, would be at risk for a given change in measured customer satisfaction. The calculation of this award rate is presented in Exhibit LK-2.

Q. How will the residential customers' satisfaction with overall handling of telephone calls be measured under the incentive plan?

A. The overall handling of calls will be measured by the percent of residential customers who claim that Telephone Service Representatives' overall handling of their phone calls is "excellent," defined to be a score of 9 or 10 on a 10-point scale. LG&E has been collecting this data in a monthly Customer Callback Survey since March 1998. The plan is to extend this survey to KU in January 1999.

Q. What are the benchmarks and deadbands for overall satisfaction with the handling of customer calls?

A. LG&E began collecting this data in 1998, so there is little historical information on how LG&E has performed in this area. There are no such data for KU since it only recently instituted a centralized call center. Because of the lack of currently-available data, the benchmarks for this measure will be developed over the course of the plan based on each company's performance. In the first plan year (1999), the benchmark will be LG&E's score on this measure in 1998. This benchmark will apply to both LG&E and KU since only LG&E's customers will be surveyed in 1998, but the survey will be extended to KU in 1999. There also will be a deadband equal

to the sample margin of error for the survey. This margin of error will be approximately +/- 5%.

In each subsequent year, the benchmark will be a moving average of each company's average score on the measure. Thus, in the year 2000, the benchmark for LG&E will be a two-year average of the percent of customers who rated call handling satisfaction as excellent in 1998-99. The benchmark for KU will be the score on the indicator in 1999, which is the first year that its customers will be surveyed. The deadbands similarly will be updated based on the margins of error that apply to the multiple years of survey data.

Q. Why is the benchmark for the overall handling of calls based on a moving average of each company's performance?

A. A moving average is likely to provide a more reliable measure of each company's historical performance. The salient alternative is to use currently-existing data as the basis for benchmarks in all years of the plan. For example, LG&E's 1998 score on the measure could be used as the benchmark for both utilities in all subsequent years. In my professional opinion, this places an excessive amount of weight on the experience of a single year. Multiple years of data are likely to increase confidence in the appropriateness of the benchmark.

A moving average benchmark also creates very strong incentives. The Companies always have financial incentives for their performance to exceed the benchmark. But when benchmarks are based on moving averages, they will be increased automatically whenever performance improves. This raises the bar for the Companies in the subsequent year.

There are also practical difficulties in using peer data to set this benchmark. While some other utilities survey their customers on their satisfaction with telephone transactions, the survey instruments may vary from those used at LG&E. This limits the comparability of results. Moreover, it is practically impossible for LG&E to extend its own Customer Callback survey to peer utilities since they do not know which customers outside their territory actually are calling utility phone centers.

It is also appropriate to have separate benchmarks for LG&E and KU. Because there are no data on the satisfaction of KU customers with call center employees, there is an inherent risk with using data for another company to set its benchmark. While this may be unavoidable in the plan's first year, the risk should not be compounded throughout the plan. Moreover, because KU customers have not historically dealt with a centralized call center, there is more uncertainty about their expressed satisfaction on the survey. There may be some

initial resistance to change, thereby reflected in lower satisfaction levels compared with LG&E customers who are more familiar with a centralized phone system. This is not to imply that KU expects lower customer satisfaction, but only that, because of historical differences in circumstances, it is not unreasonable for KU and LG&E to have different benchmarks.

Q. What is the award rate for satisfaction with the overall handling of residential customer calls?

A. For every one percent that the overall handling of calls is below the lower band, there will be an annual penalty of $72,000. For every one percent that the overall handling of calls is above the upper band, there will be an annual reward of $72,000.

Q. Please explain the basis for this award rate.

A. The principle is similar to that for overall customer satisfaction. However, since the benchmark is based on each company's own history, it is not necessary to consider the peer group when calculating the number of customers who are at risk for poor service provided by the telephone center. The calculation of this award rate is presented in Exhibit LK-3.

Employee Safety

Q. How will employee safety be measured under the plan?

A. OSHA Recordable Incidence Rate is the total number of employee accidents and illnesses per 200,000 hours worked. These data currently are collected by both LG&E and KU according to the guidelines established by OSHA.

Q. What are the benchmarks for employee safety?

A. The benchmarks for LG&E and KU will be their average OSHA Recordable Incidence Rate over the period between 1991 and 1997. For both companies, this value is 4.2. It is well below the average OSHA Recordable Incidence Rate for U.S. electric utilities over this period.

Q. Are there deadbands around these benchmarks?

A. Yes. The deadband will be equal to the standard deviation of the Companies' OSHA Recordable Incidence Rate over the same period. This value was equal to 0.81. Therefore, there will not be penalties or rewards when either company's annual OSHA Recordable Incidence Rate is between 3.39 and 5.01.

Q. What is the award rate for the employee safety measure?

A. For every 0.1 change in the OSHA Recordable Incidence Rate above the upper band, there will be an annual penalty of $130,000. For every 0.1 in the OSHA Recordable Incidence Rate below the lower band, there will be an annual reward of $130,000.

Q. Please explain how this award rate was computed.

A. The award rate for this measure is based on recent precedents from California. These precedents are valuable since the California Commission has considerable experience with safety measures in PBR. The first PBR plan approved for an energy utility in the state -- for San Diego Gas and Electric ("SDG&E") in 1994 -- included a safety measure. The PBRs recently approved for Southern California Edison ("SCE") and Southern California Gas also include safety measures.

The award rate for LG&E and KU will be based on award rates for the safety measure in the PBR plan for SCE and the most recent proposal for SDG&E. These award rates are $555,000 and $500,000, respectively, for each 0.1 change in the OSHA Recordable Incidence Rate. These values are "scaled" to the size of the LG&E and KU work forces by multiplying $527,500 by the ratio of LG&E plus KU employees to SCE plus SDG&E employees in 1997. This exercise produced a value of $128,554. This was "rounded" to the recommended award rate of $130,000.

Q. Will there be a cap on the total annual penalties or rewards that are possible under the plan?

A. Yes. It is typical in approved service quality PBR plans to cap the maximum possible reward or penalty. For each company, the maximum annual penalty or reward for service quality will

be $5 million. Relative to the companies' revenues or earnings, this cap is in line with precedents in other service quality incentive plans. No caps will be placed on rewards or penalties associated with specific measures.

Q. How will the service quality incentive be applied?

A. As with the other PBR components, service quality rewards or penalties will be levied quarterly. Each measure will be calculated quarterly on a 12-month rolling average basis. Rewards and penalties will be calculated pursuant to the Electric Rate Schedule Electric Performance-Based Rate ("EPBR") tariff as described in the testimony of Ronald L. Willhite.

Q. Does this conclude your testimony?

A. Yes it does.

VERIFICATION

STATE OF WISCONSIN)

) **SS.**

COUNTY OF DANE)

LAWRENCE KAUFMANN, being first duly sworn, deposes and states:

That he has read the foregoing testimony and knows the matters contained therein; that said matters are true and correct to the best of his knowledge and belief, except as to those matters stated on information and belief, and as to those matters, he believes them to be true.

Lawrence Kaufmann

Lawrence Kaufmann

Subscribed and sworn to before me, a Notary Public in and before said County and State, this 5 day of October, 1998.

Melinda J. Henzen

(SEAL) Notary Public

My Commission Expires:

August 6, 2000

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APPENDIX A
LAWRENCE KAUFMANN

Lawrence Kaufmann is a Senior Economist at Christensen Associates, an economic consulting firm in Madison, WI, where his primary responsibility has been to develop and undertake supporting empirical research on performance-based regulation (PBR) plans for energy utilities. His specialties include service quality incentives, code of conduct issues, estimating total factor productivity, incentive regulation theory, and monitoring PBR developments throughout the world.

In addition to Louisville Gas and Electric and Kentucky Utilities, Dr. Kaufmann has advised Hawaiian Electric, BCGas, and two other energy utilities on service quality issues. Dr. Kaufmann has worked on related PBR topics for clients as various as the power distributors in the Australian state of Victoria, San Diego Gas and Electric, Southern California Gas, Atlanta Gas Light, Public Service Electric and Gas, Boston Gas, Niagara Mohawk Power, energy regulators in Mexico and Colombia, and the United States Postal Service. He has submitted testimony in Maine on the Impact of Brand Name Restrictions in Maine's Retail Energy Markets in Docket No. 98-099. Additionally, the Edison Electric Institute (EEI) attached the report Branding Electric Utility Products: Analysis and Experience in Related Industries, of which he was the senior author, to its comments in the code of conduct proceeding in California.

Dr. Kaufmann is the author or co-author of several publications, including the forthcoming EEI reports Controlling Cross Subsidization in Electric Utility Regulation and Price Cap Regulation for Power Distribution. He holds a Ph.D. in economics from the University of Wisconsin-Madison.

CALCULATION OF FIXED AND VARIABLE PROPORTIONS OF SYSTEM-WIDE OUTAGE COSTS

The outage cost literature suggests that outages impose both fixed and variable costs on customers. Fixed costs are those that occur immediately when, for example, service interruptions disrupt an industrial customer's production plans. Variable costs are related to the duration of an outage. The relative proportions of these costs vary among customer groups. Industrial customers typically have a higher proportion of fixed costs, while residential customers usually have a lower proportion of fixed costs. This explains the frequent finding in outage cost surveys that residential customers are more willing than commercial or industrial customers to accept more frequent outages in exchange for a compensating reduction in outage duration. This reflects the fact that for residential customers, there are smaller relative costs associated simply with the occurrence of an outage.

It is possible to infer the relative values of fixed and variable outage costs for different customer groups from the outage cost literature. Caves, Herriges, and Windle present evidence on the relative proportions of fixed and variable outage costs by regressing the estimated outage costs against the hours of interruption.[1] The intercept in such a regression would represent the fixed outage costs. They find that, for a one-hour outage for residential customers, 3% of outage costs are fixed and 97% are related to outage duration. For industrial customers, the fixed and variable cost proportions are 27% and 73%, respectively.

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[1] Caves, Herriges, and Windle, *Customer Demand for Service Reliability: A Synthesis of the Outage Costs Literature*, EPRI P-6510, September 1989, p. 2-26.

The Caves et. al estimates were used to apportion LG&E/KU's system-wide outage costs into fixed and variable components. It was assumed that 3% of outage costs for residential customers are fixed and 27% of outage costs for non-residential customers are fixed.[2] The system-wide proportion of fixed costs was obtained by multiplying these estimates by the average share of kWh retail sales to residential and non-residential customers for the two companies. In 1997, 33.2% of KU kWh retail sales were residential while 31.6% of LG&E retail sales were residential. The average residential share of retail sales was therefore 32.4%. Applying this percentage to the Caves et. al estimates, 19.2% of LG&E/KU customer outage costs are fixed (i.e., 3% 0.324 + 27% .676 = 19.2%) and 80.8% are variable. With an average outage cost of $6.02 per kWh, about $1.16 of outage cost is therefore fixed and $4.86 is variable.

[2] Some developments since the time of the Caves et. al study suggest that the share of fixed outage costs has increased. The most prominent of these developments is the more widespread use of computers. However, Caves et. al do not present evidence of fixed costs for commercial customers. The share of fixed costs for these customers may be expected to be lower than for industrial customers, which was applied to all non-residential customers. The net effect of these factors on the share of fixed costs is therefore likely to be ambiguous, and in the absence of other empirical evidence we retained the fixed and variable cost estimates of Caves et. al.

CALCULATION OF AWARD RATE FOR OVERALL CUSTOMER SATISFACTION

The benchmark for the overall customer satisfaction measure is the average satisfaction of customers served by peer utilities. The award rate should therefore reflect the dollars that are at risk for a given change in LG&E/KU satisfaction relative to the peer group. The method used to estimate this value is detailed below.

1. The first step was to determine the number of customers who were at risk at LG&E because of perceived less than excellent customer satisfaction. This was done using LG&E survey data available from the first two quarters of 1998 ("1998HI") in the following way:

   In 1998HI, 69.75% of LG&E customers rated satisfaction as either 9 or 10; 0.35% of these customers said, if given a choice, they would leave LG&E. Thus an estimated 0.24% of LG&E customers will leave regardless of their satisfaction (0.24% = 0.35% of 69.75%).

   29.9% of LG&E customers rated their satisfaction between 1-8 (numbers may not sum to 100% because some customers responded "Don't Know", "No opinion" or refused to respond altogether on overall satisfaction); 2.5% of these customers said they would leave LG&E if given a choice. This corresponds to about 0.75% of total customers (2.5% of 29.9%).

Since the factor distinguishing these groups is their expressed satisfaction score, the difference between these percentages was taken as the percentage of customers who are "at risk" because of less than excellent customer satisfaction. This value is 0.51% for LG&E.

2. Similar calculations were performed for the peer group as a whole.

On average, 55.6% of peer group customers rated satisfaction as 9 or 10; 1.85% of these customers said they would leave their utility if given a choice. Therefore about 1.0% of peer customers will leave regardless of satisfaction.

43.1% of peer customers rated satisfaction between 1 and 8; 9.55% of these customers said they would leave their utility if given a choice. This corresponds to 4.1% of customers.

The difference between these percentages of 3.1% is the percentage of peer customers at risk because of less than excellent customer satisfaction.

3. The next step was to assume that the difference between the percentage of at risk customers at the peers and at LG&E is proportional to the difference in the percent of customers who say that overall satisfaction is excellent. Therefore a 14.15% difference between the top two box scores at LG&E and the peers (69.75% minus 55.6%) corresponds to having 2.59% fewer customers at risk (3.10% - 0.51%). Thus each 1% change in customer satisfaction in the top two boxes at LG&E relative to the peer group implies a -0.183% change in the number of customers at risk. The negative sign means that fewer customers are at risk when customer satisfaction improves while a decline in satisfaction means more customers at risk.

This sign is ignored below because the incentive mechanism is designed to reflect this relationship.

4. As applied to the average number of residential customers for LG&E and KU, a 1% change in customer satisfaction translates into a change in 622 customers at risk (i.e. (.183%) * (340,000 residential customers, on average, between the companies) = 622 customers at risk).

5. The associated dollars at risk are computed by multiplying the number of customers at risk by the base rate revenue in an average residential bill. Residential bills are used because only residential customers are surveyed. Base rates are relevant because, in a hypothetical competitive industry, these would be the revenues that are lost if customers are able to bypass the utility completely - including the bypass of transmission and distribution service. This assumes that all fuel-related costs are immediately avoided with bypass. In 1997, average annual base rate revenues for KU and LG&E residential customers was $460. Therefore the award rate was equal to $460*622 or $290,785 for each percentage change in overall customer satisfaction relative to peers. This value was rounded to the recommended award rate of $290,000.

CALCULATION OF AWARD RATE FOR SATISFACTION WITH OVERALL HANDLING OF TELEPHONE CALLS

Using information to date from LG&E's Customer Callback Survey and the LG&E Competitive Satisfaction Survey data, the award rate for Overall Handling of Customer Calls was calculated as follows:

1. The first step was to identify from the Customer Callback Survey the percent of surveyed customers in the top two boxes (overall handling of call excellent) and those in the bottom eight boxes (overall handling of call less than excellent); in 1998QI, these percentages were 62.0% and 38%, respectively.

2. The next step was to identify the fraction of customers who rated overall satisfaction with LG&E in the top two boxes who also rated handling of call in the top two boxes; this fraction was equal to 86.7%.

3. The next step was to identify the fraction of customers who rated overall satisfaction with LG&E in the top two boxes who also rated handling of call in the bottom eight boxes; this fraction was equal to 13.3%

4. The difference between steps 2 and 3 is a measure of the impact of call handling quality on the percent of customers who rate overall customer satisfaction as excellent; since 86.7% minus 13.3% = 73.4%, 73.4% fewer customers rate overall satisfaction as excellent when call handling satisfaction is less than excellent.

5. Since 38% of customers rate call handling as less than excellent, each 1% change in the number of customers who move out of the bottom eight boxes and into the top two boxes will correspond to an estimated 1.93% change in excellent overall satisfaction (=73.4%/38%).

6. Because the benchmark for this measure is the company's own history rather than the performance of peers, the award rate should reflect customers who are at risk because of perceived poor quality relative to the company's past rather than relative to peers. In 1998QI, LG&E's Competitive Satisfaction Survey shows that 0.7% of customers are at risk when overall customer satisfaction is 9 or 10 and 2.8% are at risk when overall customer satisfaction is between 1 through 8. An additional 2.1% of customers are therefore at risk when LG&E fails to satisfy its own customers (without taking the peers into consideration).

7. Since 29.7% of customers rate overall satisfaction between 1 and 8, each 1% of customers that move out of the bottom eight and into the top two boxes for overall customer satisfaction reduces the percentage of customers at risk by .07% (2.1% / 29.7% = .07%).

8. Using the same residential customer and base rate revenue data presented in Exhibit LK-2, a 1% change in LG&E's customer satisfaction relative to recent history – rather than relative to peers - corresponds to $111,265 at risk ($111,265 = (.07%)*(340,000 customers)*($467.50/customer)).

9. From step 5, a 1% change in customers whose Call Handling satisfaction is excellent leads to an estimated 1.93% change in customers whose Overall Satisfaction is excellent; from step 8, a 1% change (relative to the company's history) in customers whose Overall Satisfaction is excellent has a value of $111,265; therefore the value of a 1% change in Call Handling satisfaction is equal to $111,265 * 1.93 = $214,741.

10. However, it must be recognized that only a fraction of customers contact the call center in a given year and are therefore potentially "at risk" because of poor call center quality. For LG&E, it is estimated that 1 in 3 customers call each year. Therefore the value in step 9 is divided by 3 to yield $71,580. This value was rounded to the recommended award rate of $72,000.